

# DIVISION OF DESIGN AND CONSTRUCTION

## QUALITY ASSURANCE GUIDELINE

### BACKGROUND

A core principle of the Denver Service Center (DSC) is the production of high quality construction documents for projects that conserve natural and cultural resources, enhance visitor experience and park operations, and demonstrate leadership in sustainable design. In order to accomplish this goal, appropriate quality standards must be developed, implemented, and enforced. This requires that a formal Quality Assurance Program be established.

The federal acquisition Regulation (FAR) states:

#### **46.102 Policy.**

Agencies shall ensure that-

- (a) Contracts include inspection and other quality requirements, including warranty clauses when appropriate, that are determined necessary to protect the Government's interest;
- (b) Supplies or services tendered by contractors meet contract requirements;
- (c) Government contract quality assurance is conducted before acceptance (except as otherwise provided in this part), by or under the direction of Government personnel;

### PROCEDURES

DSC Division of Design and Construction Quality Assurance is defined as "Ensuring that the delivered products meet the established programmatic, performance and technical requirements of the project, that design standards are adhered to, that the design conserves the natural and cultural resources and is appropriate for the location, and that the NPS design ethic is sustained."

The DSC Quality Assurance Process will confirm that the project:

- complies with NPS policies and guidelines,
- complies with applicable laws and regulations
- is within scope and budget
- meets the programmatic requirements
- is appropriate for the location
- sustains the NPS design ethic
- complies with health, safety, and functional requirements
- construction documents are adequate to construct the intended facility

The Architect-Engineer is responsible for Quality Control which includes ensuring the technical accuracy, completeness, and correctness of the design, cost estimate and all engineering aspects and details, including coordination of all disciplines with each other and with the specifications.

This is consistent with the FAR, which states:

**52.236-23 Responsibility of the Architect-Engineer Contractor.**

As prescribed in 36.609-2(b), insert the following clause:

**RESPONSIBILITY OF THE ARCHITECT-ENGINEER CONTRACTOR (APR 1984)**

(a) The Contractor shall be responsible for the professional quality, technical accuracy, and the coordination of all designs, drawings, specifications, and other services furnished by the Contractor under this contract. The Contractor shall, without additional compensation, correct or revise any errors or deficiencies in its designs, drawings, specifications, and other services.

(b) Neither the Government's review, approval or acceptance of, nor payment for, the services required under this contract shall be construed to operate as a waiver of any rights under this contract or of any cause of action arising out of the performance of this contract, and the Contractor shall be and remain liable to the Government in accordance with applicable law for all damages to the Government caused by the Contractor's negligent performance of any of the services furnished under this contract.

The A/E shall accomplish a Quality Control Review and shall make corrections prior to each submittal to the DSC.

The Project Manager or Project Specialist shall be responsible for initiating each Quality Assurance Review with the DSC Technical Branch Quality Assurance Coordinator (QARC).

Quality Assurance Reviews for all design projects shall be accomplished by the DSC Technical Branch and shall occur at the following milestones:

- 100% Draft Predesign Documents
- 100% Draft Schematic Design Documents
- Design Development Documents
- 100% Draft Construction Documents
- 100% Complete Construction Documents

Fifteen calendar days shall be allowed for completion of the Quality Assurance Review for the first four submittals, and seven calendar days for the Final Submittal.

The Quality Assurance reviewers shall use the Quality Assurance Review Checklists as a guide in performing their reviews. The checklists are designed to be comprehensive, but do not necessarily include all items that may be reviewed on a particular project. Not all items shown on the checklists are applicable to every project. In addition, not all of the Quality Assurance reviewers will be required on every project.

The Branch Chief, Technical Branch shall be required to sign off on the Advance Procurement Plan that all review comments have been satisfactorily resolved before the project can be

submitted to the Division of Contracts.

## **APPENDICES**

Appendix A – Lessons Learned

Appendix B – Quality Assurance Review Checklists

## **APPENDIX A**

### **LESSONS LEARNED**

#### **LESSONS LEARNED**

The following is a partial list of items which can lead to disputes and costly construction contract modifications.

1. Improper cross-referencing on drawings.
2. Failure to coordinate documents prior to submittal.
3. Failure to comply with Directors Order 10A and 10B.
4. References to "owner" instead of "Government"
5. References to "Architect" or "Engineer" instead of "Contracting Officer"
6. Failure to specify products in accordance with the Buy American Act.
7. Failure to coordinate Division 1 specifications with the park

**APPENDIX B**

**QUALITY ASSURANCE REVIEW CHECKLISTS**

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# CIVIL ENGINEERING QUALITY ASSURANCE CHECKLIST

## Pre-design

\_\_\_ Required Deliverables Submitted

## Schematic Design

\_\_\_ Required Deliverables Submitted

\_\_\_ Water System Design Flow Calculations

\_\_\_ Wastewater System Design Flow Calculations

\_\_\_ Water Treatment Process Identified/Sizing Calculations

\_\_\_ Wastewater Treatment Process Identified/Sizing Calculations

\_\_\_ Site Access and Circulation, Traffic and Parking Studies/Calculations

\_\_\_ Environmental/Geotechnical Studies/Hazardous Materials Studies

\_\_\_ Site Plans/Grading Plans/ Demolition plans

## Design Development

\_\_\_ Required Deliverables Submitted

\_\_\_ Adherence to AWWA/NSF/SDWA Requirements and NPS Management Policies (2001)

\_\_\_ Adherence to Requirements in 40 CFR 131, Water Quality Standards

\_\_\_ Adherence to Requirements in 40 CFR 63, Wastewater Standards

\_\_\_ Existing Conditions Site Plan (Roads, Parking Areas, Structures, Walks, Utility Systems)

\_\_\_ Proposed Site Plan (Roads, Parking Areas, Structures, Walks, Utility Systems)

\_\_\_ Water System Layout and Components (Collection, Treatment, and Distribution)

\_\_\_ Wastewater System Layout and Components (Collection, Treatment, and Disposal)

\_\_\_ Roadway Layout, Cross-Sections, Profiles

\_\_\_ Drainage Structures/Culverts/Catch Basins/Storm Sewer

\_\_\_ Water Line/Sewer Line Profile Sheets

\_\_\_ Water Treatment Plant Equipment Layout

\_\_\_ Wastewater Treatment Plant Equipment Layout

\_\_\_ Outline Specifications Submitted for All Required Sections

## 100% Draft Construction Documents

\_\_\_ Required Deliverables Submitted

- \_\_\_ Adherence to AWWA/NSF/SDWA Requirements and NPS Management Policies (2001)
- \_\_\_ Adherence to Requirements in 40 CFR 131, Water Quality Standards
- \_\_\_ Adherence to Requirements in 40 CFR 63, Wastewater Standards
- \_\_\_ Existing Conditions Site Plan (Roads, Parking Areas, Structures, Walks, Utility Systems)
- \_\_\_ Proposed Site Plan (Roads, Parking Areas, Structures, Walks, Utility Systems)
- \_\_\_ Water System Layout and Components (Collection, Treatment, and Distribution)
- \_\_\_ Wastewater System Layout and Components (Collection, Treatment, and Disposal)
- \_\_\_ Roadway Layout, Cross-Sections, Profiles
- \_\_\_ Drainage Structures/Culverts/Catch Basins/Storm Sewer
- \_\_\_ Water Line/Sewer Line Profile Sheets
- \_\_\_ Water Treatment Plant Equipment Layout
- \_\_\_ Wastewater Treatment Plant Equipment Layout
- \_\_\_ Complete Specifications Submitted for All Required Sections
- \_\_\_ Water Meter Sizing/Locations in Accordance with NPS Policy
- \_\_\_ Confirm Capacity/Pressures of Water Storage Structures/Pressure Tanks in Accordance with NPS Policy
- \_\_\_ Temporary Water/Sewer Service Adequately Identified
- \_\_\_ Pump Controls Clearly Identified
- \_\_\_ Survey Control/Layout Information Provided
- \_\_\_ Valve Sizing and Locations Clearly Identified
- \_\_\_ Drain Sizing and Locations Clearly Identified
- \_\_\_ Lift Station Sizing and Locations Clearly Identified
- \_\_\_ Piping Sizes and Alignments/Offsets Clearly Identified
- \_\_\_ Fire Hydrant Locations Clearly Identified
- \_\_\_ Distances Between Manholes in Accordance with Standards
- \_\_\_ Pressure Reducing Valve/Air Relief Valve Sizing and Locations Clearly Identified
- \_\_\_ Disinfection System Components/Layout in Accordance with NSF Requirements
- \_\_\_ Chemical Injection System Components/Layout in Accordance with NSF Requirements
- \_\_\_ Chemical Storage Components/Layout in Accordance with NSF Requirements
- \_\_\_ Piping Alignments/Stationing/Materials/Size/Transitions/Tracer Wire Clearly Identified
- \_\_\_ Trench Details in Accordance with Geotechnical Investigations
- \_\_\_ Traffic Control/Traffic Markings/Signage Details Provided
- \_\_\_ Pipe Supports/Hangers/Thrust Blocks Provided for Adequate Support
- \_\_\_ Manhole/Sewer Cleanout Locations/Details Provided



- \_\_\_ Asphalt/Concrete Pavement Sections/Details Provided
- \_\_\_ On-Site Wastewater Treatment/Disposal Systems Provide Adequate Layout Information and Detailed Cross-Sections
- \_\_\_ Process and Instrumentation Diagrams Included for Water/Wastewater System Controls
- \_\_\_ Comfort Station Layout/Equipment/Fixtures In Accordance with NPS Policy
- \_\_\_ Utility Demolition/Abandonment Clearly Identified and in Accordance with NPS Policy
- \_\_\_ Storm Water Prevention Plan/Silt Fencing/Restoration Details Provided
- \_\_\_ Trenchless Technology Details Provided
- \_\_\_ Pavement Repair Details Provided
- \_\_\_ Utility Switch-Over Sequences and Plans Provided
- \_\_\_ Water/Wastewater Treatment Plant Switch-Over and Start-up Sequences and Plans Provided
- \_\_\_ Utility Service Connection/System By-Pass Details Provided
- \_\_\_ Confirm Minimum Water Pressure Supplied In Distribution System Network
- \_\_\_ Confined Space/Access/Venting Requirements
- \_\_\_ Cross-Connection Controls Implemented
- \_\_\_ Utility Line Crossing/Separation Requirements
- \_\_\_ Seasonal Operation Requirements Implemented

### Submit 100% Complete Construction Documents for Final Approval

- \_\_\_ Required Deliverables Submitted
- \_\_\_ All Review Comments from 100% Draft Review Satisfactorily Resolved

# LANDSCAPE ARCHITECTURAL QUALITY ASSURANCE CHECKLIST

## Pre-design

### Within Scope and Budget

- ☐ Site program matches PMIS scope, budget
- ☐ Project scope matches GMP or other planning document
- ☐ Class C estimate includes appropriate site development

### NEPA/106 Compliance

- ☐ ESF is complete

### LA Design Standards (Sustainability)

- ☐ Proposed design adequately addresses site needs of PMIS project
- ☐ Site analysis complete, supports proposed design
- ☐ Site design utilizes previously disturbed areas (brownfields) before new sites developed
- ☐ Accessibility issues identified, universal access incorporated

### NPS Policies and Guidelines (NPS ethic)

- ☐ Proposed design reflects park design standards, HSR, CLR
- ☐ Proposed design adequately addresses site needs of PMIS project

### Coordination

- ☐ Architectural and site program/analysis coordinated with no conflicting elements

### Completeness

- ☐ Required deliverables submitted

## Schematic Design

### Scope and Budget

\_\_\_ Site development matches DAB approved scope, budget

\_\_\_ Class B estimate includes appropriate site development

### **NEPA/106 Compliance**

\_\_\_ Required environmental/cultural studies identified in ESF are complete, support proposed design

\_\_\_ EA/CE complete, additional needs and permitting identified, scheduled

### **LA Design Standards (Sustainability)**

\_\_\_ Design is appropriate for site, building orientation, site drainage, access

\_\_\_ Natural drainages are preserved

\_\_\_ Building, parking and walks sited to minimize site disturbance

\_\_\_ Outdoor use areas are sited to provide adequate shading, interpretation, views, appropriate seating, width for function

\_\_\_ Common utility/vehicular/pedestrian corridor utilized

\_\_\_ ADA requirements are met, universal access, number of parking spaces @ 2% maximum grade, 5% maximum walks or 8% with handrails

### **NPS Policies and Guidelines (NPS ethic)**

\_\_\_ Adequate value-based decision tools utilized

\_\_\_ DAB recommendations are incorporated

\_\_\_ Proposed design reflects park design standards, HSR, CLR

### **Coordination**

### **Completeness**

\_\_\_ Required deliverables submitted

\_\_\_ All review comments from Pre Design Review satisfactorily resolved

### **Design Development**

### **Within Scope and Budget**

\_\_\_ Site development matches DAB approved scope, budget

\_\_\_ (VA) recommendations addressed

\_\_\_ Class B estimate includes appropriate site development

## **NEPA/106 Compliance**

- \_\_\_ Developed area is same as that cleared by (EA), all utility requirements within site cleared by NEPA document
- \_\_\_ Compliance is complete, needed permits identified, scheduled

## **LA Design Standards (Sustainability, Accessibility)**

- \_\_\_ Demolition Plan clearly identifies site elements to be removed AND protects resources to remain, provides adequate tree protection
- \_\_\_ Demolition instructions are clear on what to remove and what to remain, and are coordinated with design documents.
- \_\_\_ Design minimizes amount of impervious surface constructed
- \_\_\_ Site Plans adequately distinguishes existing conditions from proposed development
- \_\_\_ Site layout, materials and form are appropriate for climatic region
- \_\_\_ ADA requirements are met, universal access, number of parking spaces @ 2% maximum grade, 5% maximum walks or 8% with handrails
- \_\_\_ Road and parking turning radii appropriate for use identified
- \_\_\_ Culverts are sized adequately to reduce maintenance
- \_\_\_ Outline Specifications clearly reflect overview of treatment and quality that is presented in the drawings
- \_\_\_ Building location meets all setback requirements, zoning codes, and deed restrictions.

## **NPS Policies and Guidelines (NPS ethic)**

- \_\_\_ Proposed design/details reflect park design standards, HSR, CLR
- \_\_\_ NPS cover sheet is used, clearly indicating park boundaries, limits of proposed work, and any historic district boundaries
- \_\_\_ Drawings comply with Director's Order and Reference Manual 10A, DSC CAD Users Guide, and NPS/DSC Cad Drafting Standards

## **Coordination**

- \_\_\_ Organization of discipline drawings such as civil, landscape architectural, architectural, followed by structural, then HVAC, plumbing, fire protection, and electrical complies with Director's Order and Reference Manual 10A.
- \_\_\_ Spot elevations match site, civil, landscape, architectural and structural drawings.
- \_\_\_ Limits of construction match landscape, civil, plumbing, and electrical site plans.
- \_\_\_ Site property lines and existing conditions match survey and civil drawings.

## **Completeness**

- ☐ Required deliverables submitted
- ☐ All review comments from Schematic Design Review satisfactorily resolved

## **100% Draft Construction Documents**

### **Scope and Budget**

- ☐ Class A estimate within budget
- ☐ Class A estimate includes appropriate site development

### **NEPA/106 Compliance**

- ☐ Compliance is complete

### **LA Design Standards (Sustainability)**

- ☐ NPS landscape architectural standards followed
- ☐ Appropriate treatment and “quality” of materials are represented in the Specifications
- ☐ Site elevations match plans and have the same scale (or exaggerated vertical scale).
- ☐ ADA requirements are met, universal access, number of parking spaces @ 2% maximum grade, 5% maximum walks, or 8% with handrails
- ☐ Road, parking and site wall designs consistent with Geotechnical Report
- ☐ Utility corridor width is adequate for depth of burial and utility separation
- ☐ Expansion and control joint spacing in walks, slabs-on-grade and walls
- ☐ Retaining wall foundations shown in the correct locations with no site/vegetation interference
- ☐ Footing width of walls shown with no site/vegetation conflicts
- ☐ Mortar and grout specified correctly
- ☐ All required specification sections provided
- ☐ Wood treatment – no CCA

### **NPS Policies and Guidelines (NPS ethic)**

- ☐ Proposed design/details reflect park design standards, HSR, CLR
- ☐ Specifications follow NPS format and include contract price or bid schedule
- ☐ Drawings comply with Director’s Order and Reference Manual 10A, DSC CAD Users Guide, and NPS/DSC Cad Drafting Standards

## **Coordination**

- \_\_\_ Site sections match elevations, plans, and structural drawings.
- \_\_\_ Site plan match lines are consistent on site, civil, mechanical, plumbing, and electrical site drawings

## **Completeness (documents adequate to construct intended facility)**

- \_\_\_ Required deliverables submitted
- \_\_\_ All review comments from Design Development Review satisfactorily resolved

## **Submit 100% Complete Construction Documents for Final Approval**

- \_\_\_ Required deliverables submitted
- \_\_\_ All review comments from 100% Draft Review satisfactorily resolved

# ARCHITECTURE QUALITY ASSURANCE CHECKLIST

## Pre-design

- \_\_\_ Architectural Design Program documentation aligns with PMIS and Budget are incorporated.
- \_\_\_ Required deliverables submitted
- \_\_\_ Contextual Design demonstrated

## Schematic Design

- \_\_\_ Post-DAB recommendations are incorporated
- \_\_\_ Required deliverables submitted

## Design Development

- \_\_\_ Compliance Drawings clearly indicate proposed impacts of recommended treatments
- \_\_\_ Adaptive-Use floor plans clearly distinguish old from new.
- \_\_\_ NPS cover sheet is used, clearly indicating park boundaries, limits of proposed work, and any historic district boundaries
- \_\_\_ Drawings comply with Director's Order and Reference Manual 10A, DSC CAD Users Guide, and NPS/DSC Cad Drafting Standards.
- \_\_\_ Outline Specifications clearly reflect overview of treatment and quality that is presented in the drawings
- \_\_\_ Organization of discipline drawings such as civil, landscape architectural, architectural, followed by structural, then HVAC, plumbing, fire protection, and electrical complies with Director's Order and Reference Manual 10A.
- \_\_\_ Site property lines and existing conditions match with surveyor civil drawings.
- \_\_\_ Limits of construction match with landscape, civil, plumbing, and electrical site plans.
- \_\_\_ Building location meets all setback requirements, zoning codes, and deed restrictions.
- \_\_\_ Elevation points match with site, civil, landscape, architectural and structural drawings.
- \_\_\_ Demolition instructions are clear on what to remove and what to remain, and are coordinated with design documents.
- \_\_\_ Architectural space requirements are commensurate with ductwork, conduit, piping, light fixtures, elevators, and other equipment.
- \_\_\_ All plans, elevations and details are accessibility (ADA) compliant where required.
- \_\_\_ Orientation of all site, floor, and ceiling plans is consistent.
- \_\_\_ Large-scale plans and sections match small scale plans and sections.
- \_\_\_ Locations of columns, bearing walls, grid lines and overall building dimensions match structural.
- \_\_\_ Equipment room or areas are commensurate with mechanical, electrical, and plumbing.

- \_\_\_ Modern structural, mechanical, and electrical components are hidden behind historic surfaces to the greatest extent possible.
- \_\_\_ Locations of expansion joints on floors and elevations match the structural drawings.
- \_\_\_ Required deliverables submitted

### 100% Draft Construction Documents

- \_\_\_ Building elevations match floor plans and have the same scale.
- \_\_\_ Building sections match elevations, plans, and structural drawings.
- \_\_\_ Building plan match lines are consistent on architectural, structural, mechanical, plumbing, and electrical drawings.
- \_\_\_ Specifications follow NPS format and include contract price or bid schedule
- \_\_\_ Appropriate treatment and “quality” of materials is represented in the Specifications
- \_\_\_ Structural member locations are commensurate architecturally.
- \_\_\_ Chases match on structural, mechanical, plumbing, and electrical drawings.
- \_\_\_ Section and detail call-outs are proper and accurately cross-referenced. Location of details and call-outs on detail sheets, such as left to right, and top to bottom, is consistent.
- \_\_\_ Reflected architectural ceiling plans match with structural, mechanical, plumbing, fire protection, and electrical plans.
- \_\_\_ Columns, beams, and slabs are shown and noted on elevations and sections.
- \_\_\_ Door schedule information matches plans, elevations, fire rating, and specifications.
- \_\_\_ Cabinets and millwork will fit in available space.
- \_\_\_ Through-the-wall flashing and weep holes are provided where moisture may penetrate the outer material.
- \_\_\_ Appropriate flashing materials and gauges are selected.
- \_\_\_ Walls, ceilings, fire and smoke dampers are fire rated as required.
- \_\_\_ Miscellaneous metals are detailed, noted, and coordinated with the Specifications.
- \_\_\_ The limits, types, and details of insulation are coordinated with design documents.
- \_\_\_ The limits, types, and details of roofing are coordinated with design documents.
- \_\_\_ All window walls, expansion joints, and weeps are provided as required.
- \_\_\_ Dew point locations in walls, roofs, and terraces have been determined, and vapor retarders have been provided where required.
- \_\_\_ Paint and material colors are in the finish schedule on the drawings or in the specifications where appropriate.
- \_\_\_ Appropriate glazing materials such as tempered, laminated, etc., are indicated in drawings and specifications where required.
- \_\_\_ Paint samples are taken from unweathered locations, and used to match modern paints to historic colors.



- \_\_\_ Drain-back piping of fire sprinkler systems are coordinated with architectural spaces, structural members, mechanical drainage piping and ductwork, and electrical fixtures and equipment.
- \_\_\_ Required deliverables submitted

### Submit 100% Complete Construction Documents for Final Approval

- \_\_\_ Required deliverables submitted
- \_\_\_ All review comments from 100% Draft Review satisfactorily resolved

# PRESERVATION ARCHITECTURE QUALITY ASSURANCE CHECKLIST

## Historic Structure Reports Part 1 and 2

- ☐ Admin Data
- ☐ **Part 1 Developmental History**
- ☐ Chronology of Development and Use
- ☐ Historic/Existing Condition Photographs
- ☐ Photographer and Caption
- ☐ **Part 2 Treatment and Use**
- ☐ Ultimate treatment and Use
- ☐ Alternative Treatment
- ☐ Recommended Treatments
- ☐ Existing Condition drawings
- ☐ Recommended Treatment Drawings
- ☐ **Part 3 (If Used)**
- ☐ Completion Report
- ☐ The intent of the work,
- ☐ The way in which the work was approached and accomplished,
- ☐ The time required to do the work, and
- ☐ The cost of the work.
- ☐ Information about the history of the structure based on physical evidence discovered during construction.
- ☐ Technical Data
- ☐ Copies of field reports
- ☐ Material data sheets
- ☐ Field notes
- ☐ Correspondence
- ☐ Accounting spread sheets
- ☐ Contract summaries

## Pre-design

- ☐ Architectural Design Program documentation aligns with PMIS and Budget
- ☐ Adaptive Use Design Program Narrative
- ☐ Square Feet

- \_\_\_ Adjacencies
- \_\_\_ Functions
- \_\_\_ Historic Structure Report recommendations and/or Secretary of the Interior Standards of Rehabilitation are incorporated.
- \_\_\_ Site coordination/conflicts
- \_\_\_ Required deliverables submitted

### Schematic Design

- \_\_\_ Life Safety Issues
- \_\_\_ Egress
- \_\_\_ Areas of Assembly
- \_\_\_ Elevator lobby area of refuge
- \_\_\_ Constructability Issues
- \_\_\_ Existing Condition Drawings
- \_\_\_ Demolition drawings
- \_\_\_ Clearly distinguish between old and new
- \_\_\_ Required deliverables submitted

### Design Development

- \_\_\_ Post-DAB recommendations are incorporated
- \_\_\_ Compliance Drawings clearly indicate proposed impacts of recommended treatments
- \_\_\_ Drawings clearly indicate historic fabric to be removed or affected in any manner
- \_\_\_ Adaptive-Use floor plans clearly distinguish old from new.
- \_\_\_ Adaptive Use Design
- \_\_\_ Fire Suppression
- \_\_\_ Sprinkled?
- \_\_\_ ADA modification issues
- \_\_\_ Character-Defining Features
- \_\_\_ Programmatic Issues
- \_\_\_ Hazmat Issues
- \_\_\_ LBP Paint and glazing putty
- \_\_\_ Asbestos Insulation
- \_\_\_ Insects (Termites/carpenter Ants)
- \_\_\_ LA coordination/conflicts
- \_\_\_ CE coordination/conflicts

- \_\_\_ ME coordination/conflicts
- \_\_\_ SE coordination/conflicts
- \_\_\_ EE coordination/conflicts
- \_\_\_ NPS cover sheet is used, clearly indicating park boundaries, limits of proposed work, and any historic district boundaries
- \_\_\_ Outline Specifications clearly reflect overview of treatment and quality that is presented in the drawings
- \_\_\_ Organization of discipline drawings such as civil, landscape architectural, architectural, followed by structural, then HVAC, plumbing, fire protection, and electrical complies with Director's Order and Reference Manual 10A.
- \_\_\_ Site property lines and existing conditions match with surveyor civil drawings.
- \_\_\_ Limits of construction match with landscape, civil, plumbing, and electrical site plans.
- \_\_\_ Building location meets all setback requirements, zoning codes, and deed restrictions.
- \_\_\_ Elevation points match with site, civil, landscape, architectural and structural drawings.
- \_\_\_ Demolition instructions are clear on what to remove and what to remain, and are coordinated with design documents.
- \_\_\_ Architectural space requirements are commensurate with ductwork, conduit, piping, light fixtures, elevators, and other equipment.
- \_\_\_ All plans, elevations and details are accessibility (ADA) compliant where required.
- \_\_\_ Orientation of all site, floor, and ceiling plans is consistent.
- \_\_\_ Large-scale plans and sections match small scale plans and sections.
- \_\_\_ Locations of columns, bearing walls, grid lines and overall building dimensions match structural.
- \_\_\_ Modern structural, mechanical, and electrical components are hidden behind historic surfaces to the greatest extent possible.
- \_\_\_ Locations of expansion joints on floors and elevations match the structural drawings.
- \_\_\_ Required deliverables submitted

### 100% Draft Construction Documents

- \_\_\_ Preservation Issues
- \_\_\_ Restoration Issues
- \_\_\_ Reconstruction Issues
- \_\_\_ Mortar Issues
- \_\_\_ Is Portland cement used inappropriately on structures that were too old to have been built with it?
- \_\_\_ Masonry pointing
- \_\_\_ Paint Issues
- \_\_\_ Has a paint Conservator been involved in sampling and testing?

- \_\_\_ Are linseed oil based products being used on exterior walls and trim where mildew could be a problem?
- \_\_\_ Is paint specified for weathered wood where PPG Permanizer Plus should be used?
- \_\_\_ Window and Door Issues
- \_\_\_ Schedules
- \_\_\_ Door and Window Details
- \_\_\_ Door and Window Elevations
- \_\_\_ Roofing Issues
- \_\_\_ Glazing Issues
- \_\_\_ Building elevations match floor plans and have the same scale.
- \_\_\_ Building sections match elevations, plans, and structural drawings.
- \_\_\_ Building plan match lines are consistent on architectural, structural, mechanical, plumbing, and electrical drawings.
- \_\_\_ Specifications follow NPS format and include contract price or bid schedule
- \_\_\_ Appropriate treatment and “quality” of materials is represented in the Specifications
- \_\_\_ Structural member locations are commensurate architecturally.
- \_\_\_ Chases match on structural, mechanical, plumbing, and electrical drawings.
- \_\_\_ Section and detail call-outs are proper and accurately cross-referenced. Location of details and call-outs on detail sheets, such as left to right, and top to bottom, is consistent.
- \_\_\_ Reflected architectural ceiling plans match with structural, mechanical, plumbing, fire protection, and electrical plans.
- \_\_\_ Columns, beams, and slabs are shown and noted on elevations and sections.
- \_\_\_ Door schedule information matches plans, elevations, fire rating, and specifications.
- \_\_\_ Cabinets and millwork will fit in available space.
- \_\_\_ Through-the-wall flashing and weep holes are provided where moisture may penetrate the outer material.
- \_\_\_ Appropriate flashing materials and gauges are selected.
- \_\_\_ Walls, ceilings, fire and smoke dampers are fire rated as required.
- \_\_\_ Miscellaneous metals are detailed, noted, and coordinated with the Specifications.
- \_\_\_ The limits, types, and details of insulation are coordinated with design documents.
- \_\_\_ The limits, types, and details of roofing are coordinated with design documents.
- \_\_\_ All window walls, expansion joints, and weeps are provided as required.
- \_\_\_ Dew point locations in walls, roofs, and terraces have been determined, and vapor retarders have been provided where required.
- \_\_\_ Paint and material colors are in the finish schedule on the drawings or in the specifications where appropriate.

- \_\_\_ Appropriate glazing materials such as tempered, laminated, etc., are indicated in drawings and specifications where required.
- \_\_\_ Paint samples are taken from unweathered locations, and used to match modern paints to historic colors.
- \_\_\_ Drain-back piping of fire sprinkler systems are coordinated with architectural spaces, structural members, mechanical drainage piping and ductwork, and electrical fixtures and equipment.
- \_\_\_ Required deliverables submitted

### Submit 100% Complete Construction Documents for Final Approval

- \_\_\_ Required deliverables submitted
- \_\_\_ All review comments from 100% Draft Review satisfactorily resolved

# STRUCTURAL QUALITY ASSURANCE CHECKLIST

## Pre-design

\_\_\_ Required deliverables submitted

## Schematic Design

- \_\_\_ Required deliverables submitted
- \_\_\_ Floor framing system(s) appropriate for the structure
- \_\_\_ Roof framing system appropriate for the structure
- \_\_\_ Lateral force system appropriate for the structure

## Design Development

- \_\_\_ Required deliverables submitted
- \_\_\_ NPS structural standards followed
- \_\_\_ Correct Building Code used
- \_\_\_ Snow Load correct (1608)
- \_\_\_ Roof LL correct (1607.11)
- \_\_\_ Floor LL's correct (Table 1607.1)
- \_\_\_ Wind velocity and exposure correct (Fig 1609; 1609.4)
- \_\_\_ Seismic Ss and SI correct (Fig. 1615(1) et al)
- \_\_\_ Frost depth correct
- \_\_\_ Foundation design consistent with Geotechnical Report
- \_\_\_ Floor framing system(s) appropriate for the structure
- \_\_\_ Roof framing system appropriate for the structure
- \_\_\_ Lateral force system appropriate for the structure
- \_\_\_ Larger members for larger spans
- \_\_\_ Larger footings at more heavily loaded columns
- \_\_\_ Structural dimensions match Architectural drawings
- \_\_\_ Column orientation matches with Architectural drawings
- \_\_\_ Column grid lines match with Architectural drawings
- \_\_\_ Column and bearing wall locations match with Architectural drawings
- \_\_\_ Complete and continuous load path for gravity loads
- \_\_\_ Complete and continuous load path for lateral loads
- \_\_\_ Outline specs provided for all required sections

## 100% Draft Construction Documents

### General

- \_\_\_ Required deliverables submitted
- \_\_\_ NPS Structural standards followed
- \_\_\_ Correct Building Code used
- \_\_\_ Floor framing system(s) appropriate for the structure
- \_\_\_ Roof framing system appropriate for the structure
- \_\_\_ Lateral force system appropriate for the structure
- \_\_\_ Larger members for larger spans
- \_\_\_ Larger footings at more heavily loaded columns
- \_\_\_ Structural dimensions match Architectural drawings
- \_\_\_ Column orientation matches with Architectural drawings
- \_\_\_ Column grid lines match with Architectural drawings
- \_\_\_ Column and bearing wall locations match with Architectural drawings

### Loads

- \_\_\_ Snow Load correct (1608)
- \_\_\_ Roof LL correct (1607.11)
- \_\_\_ Floor LL's correct (Table 1607.1)
- \_\_\_ Wind velocity and exposure correct (Fig 1609; 1609.4)
- \_\_\_ Wind Importance Factor correct (Table 1604.5)
- \_\_\_ Wind Quality Assurance Plan (Exp A & B V3s > 120 mph, Exp C & D V3s > 110 mph) provided (1706)
- \_\_\_ Seismic  $S_s$  and  $S_l$  correct (Fig. 1615(1) et al)
- \_\_\_ Seismic use group correct (1612.2)
- \_\_\_ Seismic site class correct (Table 1615.1.1)
- \_\_\_ Seismic Importance Factor correct (Table 1604.5)
- \_\_\_ Seismic Design Category correct (Tables 1616.3(1)(2))
- \_\_\_  $R$ ,  $\Omega$ , and  $C_d$  correct (Table 1617.6)
- \_\_\_ Seismic Resistance Quality Assurance Plan provided (1705)
- \_\_\_ Complete and continuous load path for gravity loads
- \_\_\_ Complete and continuous load path for lateral loads
- \_\_\_ Support for mechanical and electrical equipment
- \_\_\_ Special loading conditions (cranes, heavy equipment etc.) addressed



\_\_\_ Folding partition loads accounted for

\_\_\_ Load combinations used correctly

### **Foundation**

\_\_\_ Foundation design consistent with Geotechnical Report

\_\_\_ Footing extends below frost depth (1805.2.1)

\_\_\_ Minimum footing width (1805.4.1)

\_\_\_ Footing step elevations close

\_\_\_ Seismic requirements for pile foundations

\_\_\_ Hold down locations clearly shown

### **Concrete**

\_\_\_ Minimum concrete cover shown (ACI 318-99 7.7)

\_\_\_ Tie spacing and arrangement correct

\_\_\_ Development length correct (ACI 318-99 12.2)

\_\_\_ Reinforcing continuity for negative moment areas

\_\_\_ Moment magnification considered for concrete columns (ACI 318-99 10.11,.12,.13)

\_\_\_ Control joint spacing in slabs-on-grade

\_\_\_ Expansion joints – floors, walls, roofs

\_\_\_ Crack control for reinforced concrete structures (ACI 318-99 10.6.4)

\_\_\_ Two mats of steel provided for walls 10" and thicker (ACI 318-99 14.3.4)

\_\_\_ Retaining wall reinforcing shown in the correct locations

### **Masonry**

\_\_\_ Masonry dimensions modular

\_\_\_ Control joint locations and spacing for masonry construction

\_\_\_ Bond beams shown correctly

### **Steel**

\_\_\_ Correct materials used A992 vs. A36

\_\_\_ Adequate stiffeners provided for steel members

\_\_\_ "Rolling" forces considered for purlins

\_\_\_ Second order effects considered for steel frames

\_\_\_ Complicated/unusual connection detailed

\_\_\_ Reactions/loads provided for connections not detailed

\_\_\_ Base plates – 4 anchor bolts minimum

\_\_\_ Minimum fillet weld size shown (AISC 9th Table J2.4)

\_\_\_ Special loading conditions for steel bar joists shown

\_\_\_ Bar joist connections at columns

- \_\_\_ Bar joist bridging shown
- \_\_\_ Bar joist bridging connection to wall or frame
- \_\_\_ Weld pattern for steel decks shown
- \_\_\_ Sidelap and endlap fastening
- \_\_\_ Steel decking continuous over three spans
- \_\_\_ Requirements for special inspection shown

### **Light Gage**

#### **Wood**

- \_\_\_ Notches and holes (2308.8.2)
- \_\_\_ Truss bottom chords braced for compression due to load reversals
- \_\_\_ Truss profiles provided for prefab trusses
- \_\_\_ Truss loading requirements shown
- \_\_\_ Permanent bracing of prefab trusses shown
- \_\_\_ Cross grain bending and tension avoided
- \_\_\_ Nailing schedule provided (Table 2304.9.1)
- \_\_\_ Diaphragm and shearwall nailing shown
- \_\_\_ Top plate splice detail shown
- \_\_\_ Roof diaphragm shear transfer to shearwalls shown

#### **Specs**

- \_\_\_ All required specification sections provided
- \_\_\_ Shoring and bracing of excavations
- \_\_\_ Compaction testing frequency
- \_\_\_ Appropriate cement type
- \_\_\_ Water-cement ratio 0.45 max
- \_\_\_ Testing frequency
- \_\_\_ Mortar and grout specified correctly
- \_\_\_ Wood treatment – no CCA
- \_\_\_ Materials conform to structural standards

#### **Calcs**

- \_\_\_ Deflection limits correct (Table 1604.3)
- \_\_\_ Concrete and masonry wall anchorage > 200 plf (1604.8.2)
- \_\_\_ 1/3 allowable stress increase not allowed if basic load combinations used (1605.3.1.1)
- \_\_\_ Partition live load included (1607.5)
- \_\_\_ Live load reduction (1607.9)

- \_\_\_ Roof DL corrected for slope
- \_\_\_ Unbalanced snow loading (1608.6)
- \_\_\_ Snow drifting (1608.7)
- \_\_\_ Minimum wind pressure 10 psf for MWFRS and components & cladding (1609.1.2)
- \_\_\_ Enclosed vs. partially enclosed
- \_\_\_ Wind uplift addressed
- \_\_\_ Retaining walls F.S. > 1.5 for sliding and overturning (1610.2)
- \_\_\_ Ponding on flat roofs (1611.2)
- \_\_\_ Flood loading when required (1612)
- \_\_\_ Load duration factors applied correctly for timber design (NDS-2001 Table 2.3.2)
- \_\_\_ Allowable stress adjustment factors (NDS) applied correctly (NDS-2001 Table 4.3.1)

### Submit 100% Complete Construction Documents for Final Approval

- \_\_\_ Required deliverables submitted
- \_\_\_ All review comments from 100% Draft Review satisfactorily resolved

# MECHANICAL QUALITY ASSURANCE CHECKLIST

## Pre-design

- \_\_\_ All required deliverables submitted
- \_\_\_ Class C mechanical systems cost estimate accurate and correct

## Schematic Design

- \_\_\_ All required deliverables submitted
- \_\_\_ Mechanical system(s) appropriate for the structure
- \_\_\_ Energy analysis and life cycle analysis for mechanical systems selection accurate and correct
- \_\_\_ Design narrative includes descriptions of all proposed mechanical systems (HVAC, plumbing, fire protection, fuel systems, etc.)
- \_\_\_ Class B mechanical systems cost estimate accurate and correct

## Design Development

- \_\_\_ All required deliverables submitted
- \_\_\_ Mechanical equipment locations thoroughly coordinated with architectural and structural
- \_\_\_ Main ductwork and piping runs thoroughly coordinated with architectural and structural
- \_\_\_ Outline specifications for all proposed mechanical systems
- \_\_\_ Heating and cooling load calculations accurate and correct
- \_\_\_ Plumbing design calculations accurate and correct
- \_\_\_ Fire protection design calculations accurate and correct
- \_\_\_ Revised Class B mechanical systems cost estimate accurate and correct

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- \_\_\_ Access door locations coordinated with architectural
- \_\_\_ Louvers, vents, hoods, etc. on exterior of building coordinated with architectural
- \_\_\_ Louver blankoffs coordinated with architectural
- \_\_\_ All necessary isolation valves shown General:
- \_\_\_ All required deliverables submitted
- \_\_\_ All required specification sections provided
- \_\_\_ Equipment and materials conform to NPS standards
- \_\_\_ Housekeeping pads provided for all large floor-mounted equipment
- \_\_\_ Adequate access space for equipment servicing and adequate pull space for filters, tube bundles, motors, etc. provided

- \_\_\_ Catwalks, walkways, mezzanines, etc. provided for access to equipment
- \_\_\_ Access doors provided as necessary for valves, equipment, trap primers, water hammer arresters, etc
- \_\_\_ All low point drain valves shown
- \_\_\_ UL approved closure systems where piping penetrates fire rated assemblies
- \_\_\_ Seismic restraints for tank type water heaters, hot water storage tanks, expansion tanks, equipment, piping, etc. in seismically active areas
- \_\_\_ All mechanical systems power requirements thoroughly coordinated with electrical
- \_\_\_ Specifications thoroughly coordinated with drawings
- \_\_\_ Class A mechanical systems cost estimate accurate and correct

#### HVAC:

- \_\_\_ HVAC systems designed to conform to all applicable codes and standards
- \_\_\_ Combustion air provided for fuel-burning appliances
- \_\_\_ Proper clearances to combustibles provided for fuel-burning appliances
- \_\_\_ Proper venting provided for fuel-burning appliances
- \_\_\_ Ventilation air provided per ASHRAE 62
- \_\_\_ Restroom ventilation systems provided (unless operable windows or other passive systems can provide required ventilation function)
- \_\_\_ Ductwork and damper arrangements for air side systems correct
- \_\_\_ Ductwork sized correctly
- \_\_\_ Fire dampers where ductwork penetrates fire rated assemblies
- \_\_\_ Combination smoke and fire dampers shown where necessary and coordinated with electrical
- \_\_\_ Duct smoke detector locations shown and coordinated with electrical
- \_\_\_ All necessary air vents shown in hydronic systems
- \_\_\_ All balancing valve locations shown in hydronic systems
- \_\_\_ Proper air control and system pressurization shown for hydronic systems
- \_\_\_ Anti-freeze and anti-freeze makeup systems provided for hydronic systems that have a high probability of freezing or will be seasonally operated
- \_\_\_ Adequate pressure rating for boilers
- \_\_\_ Pressure setting for pressure relief valves correct
- \_\_\_ Piping and pumping arrangements for hydronic systems correct
- \_\_\_ Primary/secondary pumping arrangements for multiple boiler installations
- \_\_\_ Properly sized diaphragm type expansion (compression) tanks for hydronic systems
- \_\_\_ Chemical feeders (pot type) for hydronic systems
- \_\_\_ Sound attenuation measures provided where necessary

- \_\_\_ Adequate vibration isolation for pumps, fans, and other rotating or vibration producing equipment
- \_\_\_ Condensate drains with vented traps shown for all cooling coil condensate drain pans
- \_\_\_ All control device locations shown (thermostats, switches, sensors, actuators, control panels, etc.)
- \_\_\_ Control system diagrams coordinated with what is shown on the plans
- \_\_\_ Control system points list accurate and correct (DDC systems)
- \_\_\_ Control systems sequence coordinated with what is shown on the plans and what is shown on the control systems diagrams and points list
- \_\_\_ Control systems logic coordinated, correct, and unambiguous

Plumbing:

- \_\_\_ Plumbing systems designed to conform to all applicable codes and standards
- \_\_\_ Building domestic water and sewer services coordinated with civil utility plan
- \_\_\_ Pressure reducing valve(s) installed if water supply pressure  $\geq 80$  psi
- \_\_\_ Water meters on domestic water services of each building
- \_\_\_ All fixtures properly trapped and vented
- \_\_\_ All necessary cleanouts shown
- \_\_\_ Trap primers provided for infrequently used floor drains
- \_\_\_ Low-flow fixtures and fittings specified
- \_\_\_ Sump pumps and sewage ejectors where necessary
- \_\_\_ Combustion air provided for fuel-burning domestic water heaters
- \_\_\_ Proper clearances to combustibles provided for fuel-burning domestic water heaters
- \_\_\_ Proper venting provided for fuel-burning domestic water heaters
- \_\_\_ Domestic hot water expansion tank (if pressure reducing valves or check valves are installed on the domestic water service)
- \_\_\_ Double-wall heat exchangers with leakage path open to atmosphere for indirect-fired domestic water heaters
- \_\_\_ Proper discharge routing and termination for domestic water heater temperature and pressure relief valves
- \_\_\_ Cross connection control (vacuum breakers on all hose connections, backflow preventers on hydronic system makeup water connections, irrigation system connections, etc.)
- \_\_\_ Airgap fittings with outlets routed to floor drain or sink for all reduced pressure zone backflow preventers installed indoors
- \_\_\_ Water hammer arresters provided for domestic water systems with quick-closing valves
- \_\_\_ Exterior wall hydrants or hose bibbs
- \_\_\_ Hose bibbs in mechanical spaces
- \_\_\_ Domestic water piping sized correctly

- \_\_\_ Drain, waste, and vent (DWV) piping sized correctly
- \_\_\_ Oil/water separators for floor drains in automotive repair facilities
- \_\_\_ Secondary (overflow) roof drains provided (if roof drains are provided)
- \_\_\_ Earthquake shutoff valves in fuel gas services in seismically active areas
- \_\_\_ Gas meters provided in building fuel gas services (except where a single building is served by a single LP-gas tank)
- \_\_\_ Primary-secondary pressure regulation on LP-gas vapor services

Fire Protection:

- \_\_\_ Fire protection systems designed to conform to all applicable codes and standards
- \_\_\_ Proper hazard classification(s) used
- \_\_\_ Building fire protection water service coordinated with civil utility plan
- \_\_\_ Fire department connection and inspector's test valve locations shown
- \_\_\_ Risers and floor control valve stations locations shown where necessary
- \_\_\_ Locations of fire pumps and fire pump controllers shown where necessary
- \_\_\_ Locations of pressure tanks, air compressors, nitrogen bottles, etc. shown where necessary
- \_\_\_ Locations of standpipes and hose valves shown where necessary
- \_\_\_ Locations of sprinklers coordinated with architectural reflected ceiling plans
- \_\_\_ Double check valve assembly provided on fire protection water service
- \_\_\_ Tamper switches for supervised valves coordinated with electrical
- \_\_\_ Flow switches for sprinkler activation alarm(s) coordinated with electrical
- \_\_\_ Piping and valving arrangements correct for fire protection systems
- \_\_\_ Supervised control valves provided in branch lines feeding elevator machine room, elevator hoistway, computer network room, and telecommunications equipment room sprinklers

Fuel Systems:

- \_\_\_ Fuel systems designed to conform to all applicable codes and standards
- \_\_\_ Proper clearances provided between fuel storage tanks, buildings, and public ways
- \_\_\_ Vehicular impact protection for aboveground fuel storage tanks
- \_\_\_ Fire resistant fuel storage tanks specified for aboveground liquid fuel storage
- \_\_\_ Overfill spill containers, overfill protection, secondary containment, fire resistant construction, continuous leak detection monitoring, tank level monitoring (inventory control), normal vents, emergency vents, vapor recovery, anti-siphon measures, etc. provided as necessary for liquid fuel storage
- \_\_\_ Emergency shutdown switch provided for gasoline dispensing facilities
- \_\_\_ Shear valves provided for vehicular fuel dispensers
- \_\_\_ Containment sumps provided for vehicular fuel dispensers

- \_\_\_ Vapor recovery provided for vehicular fuel dispensers as necessary
- \_\_\_ Secondary containment with continuous leak detection monitoring for pressurized underground fuel piping
- \_\_\_ Line leak detection system provided for pressurized fuel piping
- \_\_\_ Excess flow valves, emergency shutoff valves, etc. provided for LP-gas fuel storage
- \_\_\_ Adequate ballast and hold-downs for underground fuel storage tanks
- \_\_\_ Adequate corrosion resistance or corrosion protection for underground fuel storage tanks
- \_\_\_ Proper piping materials and piping corrosion protection to suit the particular fuel system application

### Submit 100% Complete Construction Documents for Final Approval

- \_\_\_ Required deliverables submitted
- \_\_\_ All review comments from 100% Draft Review satisfactorily resolved



# ELECTRICAL QUALITY ASSURANCE CHECKLIST

## Pre-design

\_\_\_ Required deliverables submitted

## Schematic Design

\_\_\_ Required deliverables submitted

\_\_\_ Adequate site utilities verified for the facility

\_\_\_ Load calculations appropriate for the facility

## Design Development

\_\_\_ Required deliverables submitted

\_\_\_ NPS Electrical standards followed

\_\_\_ Primary power and telecom utilities shown

\_\_\_ Proposed utility routing shown on site plan

\_\_\_ System one-line diagram included

\_\_\_ Electrical Distribution Equipment sized and shown

\_\_\_ Fault current calculations appropriate

\_\_\_ Loads summarized for the facility

\_\_\_ Adequate spare capacity in all systems for future considerations

\_\_\_ Panelboards and larger distribution equipment are located

\_\_\_ Motor loads are identified, sized and locations shown

\_\_\_ Lighting calculations included

\_\_\_ Lighting in accordance with IESNA recommendations

\_\_\_ Lighting design sustainable (daylighting considerations, energy efficiency, FEMP)

\_\_\_ Lighting fixture type and locations are shown

\_\_\_ Lightning Protection evaluation included

\_\_\_ Fire and Intrusion alarms

\_\_\_ Egress & Emergency power and lighting needs have been addressed

\_\_\_ Itemized Electrical Estimate included

\_\_\_ Floorplan backgrounds match Architectural drawings

\_\_\_ Outline specs provided for all required sections

## 100% Draft Construction Documents

- \_\_\_ PMIS statement items specifically addressed
- \_\_\_ Required deliverables submitted
- \_\_\_ NPS Electrical standards followed
- \_\_\_ Overcurrent protection devices coordinated
- \_\_\_ AIC values correct
- \_\_\_ Disconnects sized for equipment served
- \_\_\_ Electrical Distribution Equipment proper size
- \_\_\_ Adequate working clearance around equipment
- \_\_\_ Branch circuiting for all devices
- \_\_\_ Verify occupancy type and wiring method used
- \_\_\_ Conductor fill correct
- \_\_\_ Emergency lighting identified
- \_\_\_ Fire alarm devices identified
- \_\_\_ Fire alarm notification devices located and identified (horn/strobe)
- \_\_\_ Exit Light Locations
- \_\_\_ Exit Lighting circuitry
- \_\_\_ HVAC equipment shutdown by Fire alarm equipment
- \_\_\_ Magnetic door holders coordinated with Fire alarm
- \_\_\_ Elevator code requirements
- \_\_\_ Panel Schedules completed and summarized
- \_\_\_ Transformers located with adequate clearances per O&M requirements and NEC
- \_\_\_ Individual buildings metered separately
- \_\_\_ Branch circuit identified for fire alarm control panel
- \_\_\_ Lightning protection system complies with NFPA 780
- \_\_\_ Communication riser provided
- \_\_\_ Fire alarm system approved by regional AHJ
- \_\_\_ Coordination of AV requirements with HFC complete
- \_\_\_ Reflected ceiling plan coordinated with architect (all Lighting, fire & security devices shown)
- \_\_\_ UPS system for computers
- \_\_\_ Photovoltaic system in accordance with NEC requirements
- \_\_\_ Comprehensive Fire alarm matrix
- \_\_\_ Security Riser diagram
- \_\_\_ Itemized estimate of probable electrical construction costs

- \_\_\_ All required specification sections provided
- \_\_\_ Utility contact information included in specifications
- \_\_\_ Proper Load Balance +/- 10%
- \_\_\_ 3/4 " conduit minimum
- \_\_\_ All utilities underground, unless otherwise required by cultural landscape
- \_\_\_ Special systems schematic (sound, intercom)
- \_\_\_ Control wiring schematics
- \_\_\_ Transient voltage surge suppression

### Submit 100% Complete Construction Documents for Final Approval

- \_\_\_ Required deliverables submitted
- \_\_\_ All review comments from 100% Draft Review satisfactorily resolved

# SAFETY QUALITY ASSURANCE CHECKLIST

## Pre-design

\_\_\_ Required deliverables submitted

## Schematic Design

\_\_\_ Required deliverables submitted

\_\_\_ NPS Safety (NPS Director's Order [DO] 50B) and Fire Protection (DO 58) standards identified

\_\_\_ Outline Fire Protection and Life Safety Plan (NPS Reference Manual [RM] 58)

\_\_\_ Identify all applicable Codes and Standards, including Building Code

## Design Development

\_\_\_ Required deliverables submitted

\_\_\_ NPS Safety (DO 50B) and Fire Protection (DO 58) standards followed

\_\_\_ Identified Codes and Standards, including Building Code are used

\_\_\_ Draft Fire Protection and Life Safety Plan (RM 58)

- I. General Description
- II. General Construction Aspects
- III. Occupancy Classifications
- IV. Fire Resistive Separations
- V. Doors and Windows
- VI. Interior Wall, Ceiling and Floor Finishes
- VII. Decorative Structures within Buildings
- VIII. Egress
- IX. Special Design
- X. Emergency Signage
- XI. Suppression Systems
- XII. Fire Department Access
- XIII. Fire Detection and Alarm System
- XIV. Emergency Communication Systems
- XV. Smoke Management Description
- XVI. Central Control Station
- XVII. Emergency and Standby Power
- XVIII. Elevators

\_\_\_ Provide Fire Protection Plan(s) that graphically summarize key features as described in the Fire and Life Safety Plan

\_\_\_ Outline specs provided for all required sections

### 100% Draft Construction Documents

- ☐ Required deliverables submitted
- ☐ NPS Safety and Fire Protection standards followed
- ☐ Final Fire Protection and Life Safety Plan
- ☐ Fire Protection Plan(s) that graphically summarize key features as described in the Fire and Life Safety Plan
- ☐ All required specification sections provided

### Submit 100% Complete Construction Documents for Final Approval

- ☐ Required deliverables submitted
- ☐ All review comments from 100% Draft Review satisfactorily resolved

# ROOFING/WATERPROOFING QUALITY ASSURANCE CHECKLIST

Note: This checklist applied to both “Roofing” and “Waterproofing” as applicable

## Pre-design

\_\_\_ Required deliverables submitted

## Schematic Design

\_\_\_ Required deliverables submitted

\_\_\_ Roof/waterproofing assembly(ies) appropriate for the building’s intended use, location and design life expectancy

\_\_\_ Roof/waterproofing assembly(ies) appropriate for deck type, slope, fire, wind hail, uplift and thermal requirements, vapor control, environmental requirements and cost

\_\_\_ Roof/waterproofing assembly(ies) application appropriate for climate locations considering hot and cold temperatures, wind, and precipitation

\_\_\_ For low slope roofs, 2-ply modified bitumen and a single ply membrane is the system of choice. Use a modified bitumen roof in areas that require high puncture resistance, exposure to abuse or need frequent access to maintain mechanical equipment. Use a single ply membrane on complex configured roofs, roof with many penetrations or when roof access needs are minimal

\_\_\_ Avoid ballasted, sprayed polyurethane foam, APP modified bitumen or cement composite roofs

\_\_\_ Consider steep slope roofing systems whenever feasible

\_\_\_ In high snow areas, avoid steep pitch roofs that shed snow over doors and windows. Design building shapes and roof configurations to minimize damage from sliding snow/ice to the roof itself, dormers and pipe penetrations

\_\_\_ Use cold roof techniques in areas where snow and ice can accumulate on the roof.

## Design Development

\_\_\_ Required deliverables submitted

\_\_\_ Building Code compliance with fire rating classification, wind classification and hail rating

\_\_\_ Comply with NPS Roofing/Waterproofing design standards and National Roofing Contractors Association Roofing and Waterproofing Manual and International Building Code

\_\_\_ Provide wind uplift calculations based on ASCE 7. Specify roof systems that meet ASCE requirements

\_\_\_ Provide roof drainage calculations for sizing roof drains, leaders, downspouts and gutters

\_\_\_ Provide written documentation for determination of required roof fire rating class using procedures in IBC or NFPA

\_\_\_ Review building’s interior temperature and humidity conditions and climate to determine vapor barrier requirements. Calculate dew point location within the wall and roof assembly

- \_\_\_ Determine compatibility of roof material with other materials that may settle onto the roof or flow off the roof
- \_\_\_ Determine need for construction sequencing and the affect it will have on roof assembly selection
- \_\_\_ Consider maintenance, repair and eventual reroofing (life cycle cost) in final selection of roofing system
- \_\_\_ Obtain roof slope by constructing slope in structural system in lieu of tapered insulation boards or lightweight concrete fill
- \_\_\_ Use of lightweight insulating concrete, gypsum fill or asphaltic perlite fill is not recommended unless the materials are extensively used in the project area and there is sufficient contractor competition
- \_\_\_ Determine roof pitch after considering potential roof deflections, and existing structural deck conditions to insure positive drainage. For low slope roofs, maintain a minimum ¼"/ft. roof slope and 1/8"/ft. along valleys by using crickets and tapered insulation. For high slope roofs, consult with codes and roofing manufacturer's limitations
- \_\_\_ Review roof configuration and roof drainage layout to provide most efficient means to remove water
- \_\_\_ Use internal roof drains in climates where freeze/thaw condition is prevalent. In freeze/thaw climates, locate gutters, downspouts, scuppers and drains in area which receive sunlight if possible
- \_\_\_ Avoid built-in gutter systems in which drainage passes through or part of the interior spaces or is concealed in exterior wall cavity
- \_\_\_ Use sidewall louvers for intake and exhaust systems whenever possible
- \_\_\_ Avoid rooftop mounted HVAC equipment when possible
- \_\_\_ Buildings over 1 story should have an internal roof access means through a manufactured roof hatch
- \_\_\_ Use of asphaltic and wood shingles and shakes in tropical climates shall be fungus resistive and wood shall be pressure treated
- \_\_\_ When reroofing, provide field investigation of existing roof and deck construction and conditions. Identify existing materials and test suspect roofing materials for asbestos. Insure existing materials are suitable and compatible with proposed roof system
- \_\_\_ Outline specs provided for all required sections

## 100% Draft Construction Documents

- \_\_\_ Required deliverables submitted
- \_\_\_ Specify modern and proven technology as used in torch down and adhesive type modified bitumen systems
- \_\_\_ Specify manufacturers that have a proven product record of 20-30 year service life without manufacturer's alterations to the material during that time span

- \_\_\_ Specify roof assemblies as a complete system to include insulation, cover board, membrane and miscellaneous accessories
- \_\_\_ Specify mechanical fastening of roof system for all nailable deck. Use adhesive for non-nailable decks per membrane manufacturer's requirements
- \_\_\_ Specify fastener nailing pattern of roof insulation, cover board and base sheet when using mechanical fasteners to deck
- \_\_\_ Specify cover board with a hard durable impermeable surface with fire resistance properties
- \_\_\_ Specify roof drain strainer to be manufactured from iron
- \_\_\_ Specify use of pressure-treated wood blocking and nailers
- \_\_\_ Specify contractor compliance with FM Loss Prevention Data Sheet 1-49 recommendations concerning edge flashing design details
- \_\_\_ Specify minimum 18 gage metal for perimeter edge or fascia strips
- \_\_\_ Specify and show manufactured 2-piece counterflashing, removable coping systems, roof edge/fascia systems to aid in future reroofing
- \_\_\_ Specify and show perimeter edge metal flashing on steep roofs
- \_\_\_ Specify the appropriate underlayment for steep roofing system
- \_\_\_ Specify opened or closed valleys for steep roofing
- \_\_\_ Specify and show eave cant for slate, concrete and tile roofing
- \_\_\_ Specify public and visitor safety requirements
- \_\_\_ Specify limits on odors, noise and dust during roof applications
- \_\_\_ Specify in project closeout that a permanent sign be affixed near a roof hatch or provided to the government indicating the type of roof membrane used, the installer, the date of expiration of the warranty and emergency telephone number.
- \_\_\_ Specify final inspection of the roof by the roof manufacturer
- \_\_\_ When possible, specify a full system warranty for low slope roofs and leakproof warranty for steep slope roofs covering labor and materials with a no dollar limit for 15 to 20 year duration
- \_\_\_ Determine type and amount of insulation required and specify installation using double layer of insulation boards
- \_\_\_ Check deck and supporting structure for ponding deflections, located drains at mid span
- \_\_\_ Roof drains coordinated with architectural, civil and mechanical drawings
- \_\_\_ Primary drains and scuppers should be sumped below the roof membrane
- \_\_\_ Show and detail primary and secondary drains and scuppers, wall and curb flashing, parapet walls, crickets and special conditions not normally detailed by the manufacturer
- \_\_\_ Show and detail all roof mounted equipment, lightning protection terminals and accessories, roof penetrations, vents, exhausts, skylights, monitors and access hatches
- \_\_\_ Mechanical equipment or electrical penetrations should not be located in valleys or drainage areas. Electrical conduit should penetrate equipment curb, not roof



- \_\_\_ Provide a 24" minimum space between penetrations, curbs, drains, perimeter, walls, etc.
- \_\_\_ Crickets shall be install upslope of mechanical equipment or building features
- \_\_\_ Review need of roof expansion joints to accommodate building thermal movement, structural framing and deck changes and building configurations
- \_\_\_ Detail special flashing details to accommodate roof to wall movement.
- \_\_\_ Show minimum curb and wall flashing heights
- \_\_\_ Show cants at 90 degree angle changes when using modified bitumen roof systems.
- \_\_\_ Mount mechanical equipment on raised curbs and show securement against wind forces
- \_\_\_ Keep roof penetrations to a minimum by consolidation of vent pipes and exhaust vents
- \_\_\_ Avoid pitch pockets whenever possible
- \_\_\_ Show continuous cleat at bottom of edge or fascia strips
- \_\_\_ Provide raised fascia edge with metal flashing at roof perimeters instead of embedded edge metal flashing
- \_\_\_ Provide through wall flashing under parapet wall caps
- \_\_\_ Provide watertight membrane under coping joints, if not under the entire coping. Coping to be sloped to shed water to roof side
- \_\_\_ Show walkway pads around mechanical equipment which requires periodic servicing
- \_\_\_ Determine need for ventilating the underside of roof with eave and ridge vents
- \_\_\_ Determine need for ice dam protection membranes
- \_\_\_ Determine need and show detail of step flashing and counterflashing at vertical surfaces
- \_\_\_ Gutters shall be sloped 1/16" per foot minimum to downspouts.
- \_\_\_ Penetrations in metal roof shall occur in the roof pan and be designed to accommodate roof movements
- \_\_\_ Provide details for lightening protection, satellite dishes, hatches, skylights, antennas and other penetrations
- \_\_\_ Flood test waterproof membranes before backfilling or placing material upon it

### Submit 100% Complete Construction Documents for Final Approval

- \_\_\_ Required deliverables submitted
- \_\_\_ All review comments from 100% Draft Review satisfactorily resolved

# DRAFTING STANDARDS QUALITY ASSURANCE CHECKLIST

## Design Development

### NPS Guidelines

Files meet requirements of:

- \_\_\_ Director's Order 10A – (Guideline for Preparation Of Design and Construction Drawings)
- \_\_\_ Director's Order 10B – (Drawing and Map Numbers Reference Manual)
- \_\_\_ CADD User's Guide – Denver Service Center
- \_\_\_ Standard cover sheet with vicinity map used. Includes appropriate approval block/revision block
- \_\_\_ Project number/solicitation number on cover
- \_\_\_ Index matches sheet titles
- \_\_\_ Legend- reflects only symbols used in the specific drawing set
- \_\_\_ Abbreviation List - reflects only abbreviations used in the specific drawing set
- \_\_\_ Project "bid options" are clearly called out and distinguishable from base bid
- \_\_\_ Standard second sht/plan & profile sht. Title block contains title of sheet and includes the park name
- \_\_\_ Do not "explode" or "burst" title blocks
- \_\_\_ All drawings include a drawing tag that includes date/time of last save, user name, the AutoCAD release version, drawing path & filename, and xref list.
- \_\_\_ All drawings drawn at true scale and true coordinates in model space.
- \_\_\_ Topo in model space in "real world"-do not move or rotate topo in model space (if rotation is necessary, rotate in paper space viewport)
- \_\_\_ Drawing names used as xrefs begin with an "x" and are located in the "bases" folder
- \_\_\_ Preference is to "overlay" xrefs (don't "attach" files, creating unnecessary xrefs in other drawings)
- \_\_\_ Coordinate format in decimal feet to the hundredths
- \_\_\_ No entities intended to be plotted are drawn with pen 8 or 9 (no plot pens)
- \_\_\_ Scale bars- no "text scales" (text scale is not accurate when drawings are reduced)
- \_\_\_ Dimension style is associative
- \_\_\_ Hatch is associative (do not explode hatch)
- \_\_\_ If "custom" hatch used – include hatch file
- \_\_\_ Drawings reflecting existing conditions (screened pen) vs. new work (100% pens) is clearly distinguishable on plots
- \_\_\_ Text- Drawing files use only romans.shx and arch.shx (all uppercase)
- \_\_\_ Drawings (linework, text, symbols etc.) legible when printed half size.

- \_\_\_ Drawings containing photos – When photos are inserted in drawings, the full-size reproducible must be capable of producing clear, legible half-size prints. In addition to the .jpg/.tif etc., submit a “hard copy” photo.
- \_\_\_ When necessary, “mask” or clear behind text for clarity (within profile grid etc.)
- \_\_\_ Existing conditions sheet- label survey control and a minimum of 3 labeled coordinate tics
- \_\_\_ Demo items are not reflected on subsequent design subsheets (only shown on existing conditions sheet and demo sheet)
- \_\_\_ Do not bind xrefs
- \_\_\_ Use relative paths for xrefs
- \_\_\_ Do not xref such items as scale bars/north arrows/std. details etc.
- \_\_\_ Use only pens/color configuration as shown in figure 4-2 of cadd users guide. (Line widths are set at the plotter and not in the model)
- \_\_\_ Drawings use color dependent plot styles, not named plot styles
- \_\_\_ Create all objects “color by layer” only
- \_\_\_ Project files comply with DSC folder structure, i.e. [park] \ [package or pmis] \ [phase] \ [discipline]
- \_\_\_ Drawing filenames conform to the DSC drawing file naming conventions (CADD Users’s Guide)
- \_\_\_ Each sub sheet is created as an individual .dwg file. (One single drawing file containing multiple subsheets is not acceptable)
- \_\_\_ Printing/plotting set in paper space at 1:1 scale for full-size prints, 1:2 scale for half size prints.
- \_\_\_ Rotate in paper space viewport- (do not rotate topo etc. in model space)
- \_\_\_ Remove all extraneous graphics and drawing entities existing outside the drawing border in order that “extents” can be set for plotting

## **Completeness**

- \_\_\_ No drawing files accepted other than in AutoCADD format (.dwg). Other formats are not acceptable (.dxf/.dgn etc.)
- \_\_\_ Deliverables– Files comply with DSC folder structure with no “old” or extraneous files included
- \_\_\_ Required deliverables for each completed stage of a project are submitted for archiving (folder structure reflects specific stage of project)
- \_\_\_ Deliverables meet Technical Information Center’s requirements for archiving

## **100% Draft Construction Documents**

- \_\_\_ All review comments from Design Development Review are satisfactorily resolved
- \_\_\_ Required deliverables submitted

## Submit 100% Complete Construction Documents for Final Approval

- \_\_\_ Required deliverables submitted
- \_\_\_ All review comments from 100% Draft Review satisfactorily resolved

## Construction Document Amendments

- \_\_\_ Construction Drawing Amendments comply with “numbering” procedures contained in Director’s Order 10B (Reference Manual for Drawing and Map Numbers)
- \_\_\_ Cover sheet revision block and drawing index reflect drawings changed
- \_\_\_ Amendments to drawings are clearly defined by “clouding” or “keying”
- \_\_\_ Required deliverables submitted

## Construction Document Modifications

- \_\_\_ Construction Drawing Modifications comply with “numbering” procedures contained in Director’s Order 10B (Reference Manual for Drawing and Map Numbers)
- \_\_\_ Cover sheet revision block and drawing index reflect drawings modified
- \_\_\_ Modifications to drawings are clearly defined by “clouding” or “keying”
- \_\_\_ Required deliverables submitted

## As-Constructed Drawings

- \_\_\_ Required deliverables submitted